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In re Patent Application of

Yuko IIDA

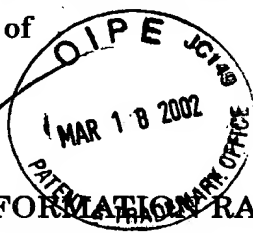
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For: PORTABLE INFORMATION RATIO TERMINAL DEVICE AND
MANUFACTURING METHOD THEREOF

Asst. Commissioner for Patents

Washington, D.C. 20231



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VERIFIED ENGLISH TRANSLATION

Sir:

I, Shunsuke Osawa, certify that I am knowledgeable in the English and Japanese languages, and that the attached document is a true translation of Japanese Patent Application NO. 11-177730 (filed on June 24, 1999).

I declare that all statements made herein of my own knowledge are true and that all statements made on information or belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of this declaration, the present application, or any patent resulting therefrom.

Date Second day of March, 2002

A handwritten signature in black ink, appearing to be "Shunsuke Osawa".

Shunsuke Osawa

**PATENT OFFICE
JAPANESE GOVERNMENT**

**This is to certify that the annexed is a true copy of the following application
as filed in this Office**

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Application Number: 11-177730

Applicant: NEC CORPORATION

April 21, 2000

Commissioner, Patent Office Takahiko Kondo

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[List of Submitted Articles]
25 [Name of Article] Specification 1
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[Name of Article] Abstract 1
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[Title of Document] Specification

[Title of Invention] PORTABLE INFORMATION RADIO TERMINAL
DEVICE AND MANUFACTURING METHOD THEREOF

[Scope of Claim for Patent]

5 [Claim 1] A portable information radio terminal device
comprising:

device body;

an electronic part provided in said device body; and

an elastic member supporting said electronic part within

10 said device body.

[Claim 2] A portable information radio terminal device
comprising:

a device body;

a printed board provided in said device body;

15 an electronic part provided on said printed board; and

an elastic member supporting said printed board within

said device body.

[Claim 3] A portable information radio terminal device as
set forth in claim 2, wherein

20 said device body includes a first and second casing to
be assembled with each other, and

said elastic member is disposed between said printed board
and said first casing and between said printed board and said
second casing.

25 [Claim 4] A portable information radio terminal device as

set forth in claim 3, wherein

a direction of an elastic force acting on said printed board from said elastic member disposed between said printed board and said first casing and a direction of an elastic force
5 acting on said printed board from said elastic member disposed between said printed board and said second casing substantially match with a direction of assembling said first and second casings.

[Claim 5] A portable information radio terminal device as
10 set forth in any one of claims 2 to 4, wherein

said elastic member is provided at only one side of said printed board in the longitudinal direction, and

the other end side of said printed board in the longitudinal direction is situated as a free end.

15 [Claim 6] A portable information radio terminal device as set forth in any one of claims 1 to 5, wherein

said device body is divided in longitudinal direction into first and second halves, and said elastic member is provided only on one of said first and second halves where a gravity
20 center of said portable information radio terminal device is located.

[Claim 7] A portable information radio terminal device as set forth in any one of claims 2 to 6, wherein

a plurality of elastic members are provided per one side
25 of said printed board.

[Claim 8] A manufacturing method of a portable information radio terminal device comprising:

step of providing a first casing;

step of providing a second casing to be assembled with
5 said first casing;

step of arranging any one of said first and second casings on said printed board via an elastic body; and

step of assembling the other of said first and second casings with said one of said first and second casings via an
10 elastic body interpositioning said elastic member between said the other of said first and second casings and said printed
[Detailed Description of the Invention]

[0001]

[Technical Field in Which Invention Belongs]

15 The present invention relates to a portable information radio terminal device and a manufacturing method thereof. More particularly, the invention relates to a portable information radio terminal device and a manufacturing method thereof, which can effectively prevent peeling off, breakage or so forth of
20 electrical connecting portion of an electronic parts mounted on a printed circuit board in a device casing.

[0002]

[Prior Art]

Conventionally, as shown in Fig. 3, a printed board
25 incorporated in a portable information radio terminal device

11 is secured in a device casing by screws 15 and bosses 17. Accordingly, when an impact is exerted on the portable information radio terminal device 11, portions secured by the screws cannot follow with vibration or deflection of the printed circuit board 12 caused by exertion of the impact to cause stress concentration about the portions secured by the screws to amplify vibration or deflection of the printed board 12. As a result, peeling can be caused in solder ball (electrical connecting portion) of a CSP (chip size package) mounted on the printed board 12.

[0003]

In Japanese Unexamined Utility Model Publication No. Showa 58-162689, the following technology has been disclosed. Disclosed in the above-identified publication is a printed board support structure of an electronic equipment, in which a printed board mounting a printed wiring and various parts, such as relays and so forth, is rigidly fixed in a casing. Elastic engaging projections are projected from a printed board mounting surface of the casing. Also, auxiliary projections are projected in opposition to the elastic engaging projections across the printed board with a distance. In the printed board, engaging holes to engage with the engaging projections are formed for forming the supporting structure of the printed board of the electronic equipment. On the other hand, between each of supporting portions of the casing and the printed board, elastic

member, such as rubber member is disposed within a space portion for accommodating tolerance.

[0004]

On the other hand, in Japanese Unexamined Patent
5 Publication No. Heisei 8-23181, the following technology has been disclosed. A circuit board has a structure to be tightly clamped by first and second rollers. When the circuit board is inserted between the first and second rollers, the first and second rollers are rotated in a board inserting direction
10 by a frictional force. With such construction, vibration to be caused in the equipment casing is absorbed to protect the circuit board from vibration. Furthermore, the circuit board can be smoothly inserted into the casing.

[0005]

15 [Problem to be Solved by the Invention]

It is desirable to maintain electrical connection of the electronic parts mounted on the board in the device body when the portable information radio terminal device is subject to an impact (external force) due to falling down or so forth.
20 It is also desired that large vibration and/or impact will not be transmitted to the electronic parts within the device body to maintain electrical connection of the electronic parts and thus not to be a cause of failure of the electronic parts.

Also, it is desired to easily produce the portable
25 information radio terminal device resistant against the impact

set forth above.

[0006]

[Means for Solving the Problem]

The figures with parenthesis appearing in the following
5 recitation, in which means for solving the problem are expressed
corresponding to claims, show corresponding to members, steps
and operations of at least one embodiment among a plurality
of implementing embodiments, in which the elements recited in
claims are discussed in detail. However, solution of the present
10 invention should not be interpreted with limiting to the members
in the embodiment, and simply for clarify correspondence.

[0007]

A portable information radio terminal device (1),
according to the present invention, comprises device body (1H),
15 an electronic part (6) provided in said device body (1H) and
an elastic member (5) supporting said electronic part (6) within
said device body (1H).

[0008]

A portable information radio terminal device (1),
20 according to the present invention, comprises a device
body (1H), a printed board (2) provided in said device body
(1H), an electronic part (6) provided on said printed board
(2) and an elastic member (5) supporting said printed board
(2) within said device body (1H).

25 [0009]

In the portable information radio terminal device (1) according to the present invention, said device body (1H) includes a first and second casing (3, 4) to be assembled with each other, and said elastic member (5) is disposed between
5 said printed board (2) and said first casing (3) and between said printed board (2) and said second casing (4).

[0010]

In the portable information radio terminal device (1) according to the present invention, a direction of an elastic
10 force acting on said printed board (2) from the elastic member (5) disposed between said printed board and said first casing (3) and a direction of an elastic force acting on said printed board (2) from said elastic member (5) disposed between said printed board and said second casing (4) substantially match
15 with a direction of assembling said first and second casings (3, 4).

[0011]

In the portable information radio terminal device (1) according to the present invention, said elastic member (5)
20 is provided at only one side of said printed board (2) in the longitudinal direction, and the other end side of said printed board (2) in the longitudinal direction is situated as a free end.

[0012]

25 In the portable information radio terminal device 1)

according to the present invention, said device body (1H) is divided in longitudinal direction into first and second halves, and said elastic member (5) is provided only on one of said first and second halves where a gravity center of said portable
5 information radio terminal device (1) is located.

[0013]

In the portable information radio terminal device according to the present invention, a plurality of elastic members (5) are provided per one side of said printed board
10 (2).

[0014]

A manufacturing method of a portable information radio terminal device according to the present invention, comprises step of providing a first casing (3), step of providing a second
15 casing (4) to be assembled with said first casing (3), step of arranging any one of said first and second casings (3, 4) on said printed board (2) via an elastic body (5) and step of assembling the other of said first and second casings (3) with said one (4) of said first and second casings (3, 4) via an
20 elastic body (5).

[0015]

The portable information radio terminal device according to the present invention reduces concentration of stress caused due in impact of falling down or the like by holding the printed
25 circuit board assembled in the device body with the elastic

body, such as shock absorbing member formed of the material having elasticity for preventing peeling of the chip, such as CSP or the like mounted on the printed board.

[0016]

5 [Mode of Implementing the Invention]

One embodiment of a portable information radio terminal device according to the present invention will be discussed hereinafter in detail with reference to the accompanying drawings.

10 [0017]

Fig. 1 shows the first embodiment of a portable information radio terminal device according to the present invention, in which Fig. 1(a) is a front elevation, and Fig. 1(b) is a section taken along line A-A. As shown in Fig. 1, a portable information radio terminal device 1 has a receiver portion 1a, a transmitter portion 1b, a liquid crystal display portion 1c and an operation portion 1d. A print board 2 assembled with a device body 1H is held through an elastic member 5.

[0018]

20 As shown in Fig. 1(b), the elastic member 5 is tightly fitted between an upper casing 3 and the printed board 2 and between a lower casing 4 and the printed board 2 without any gap under slightly pressurized condition. If gap is present, impact absorbing ability and stress distribution performance
25 can be lowered.

[0019]

When the portable information radio terminal device 1 is subject to an impact due to falling down or in other reason, a phenomenon to cause large vibration and deflection on the upper casing 3, the lower casing 4 and the printed board 2 assembled in the device body 1H occurs. At this time, vibration and deflection between the upper casing 3 and the printed board 2 and between the lower casing 4 and the printed board 4 is absorbed by the elastic member 5. Also, since bonding points of the elastic member 5 to the printed board is not single, and the elastic member 5 does not act for fix the printed board against vibration or deflection, stress concentration can be avoided. Accordingly, occurrence of large vibration on the printer board per se can be reduced. By this, CPSS 6 mounted on the printed board may not peel off the printed board 2.

[0020]

As shown in Fig. 1(a), the printed board 2 has a length in a longitudinal direction about half of that of the device body 1H to be arranged at approximately upper half in the longitudinal direction of the device body 1H. On a surface of the printed board 2 opposing to an inner surface of the lower casing 4, electronic parts, such as CSPs (Chip Size Packages) are mounted.

[0021]

Among components in the portable information radio

terminal device 1, a weight of the liquid crystal display portion 1c becomes relatively large which can be a large proportion in an overall weight of the portable information radio terminal device 1. As shown in Fig. 1 (b), since the liquid crystal display portion 1c is located at upper side of half in the longitudinal direction of the device body 1H, a gravity center of the portable information radio terminal device 1 is located at upper side of the center portion in the longitudinal direction. Accordingly, when the portable information radio terminal device 1 falls down, it inherently fall in the upside-down attitude collide at the upper side to easily subject to impact. For this reason, in order to obtain efficient impact resistance, a portion holding the printed board 2 on the device body 1H with the elastic member 5 is set at upper side in the longitudinal direction of the portable information radio terminal device 1 and in the vicinity of the uppermost position of the printed board 2.

[0022]

The printed board 2 is supported only on the side close to the uppermost position thereof to situate the other end of the printed board 2 in the longitudinal direction as free end. This works together with elasticity of the supporting portion (elastic member 5) of the printed board 5 to cause appropriate degree of elastic deformation in the printed board 2 without causing local stress concentration when external force is applied to the portable information radio terminal device 1,

to cancel energy of the external force acting on the printed board 2. Accordingly, stress concentration will not be caused in electrical connecting portion of the CSP 6 on the printed board 2 or the CSP 6 per se.

5 [0023]

A contact area of the elastic member 5 with the printed board 2 and a contact area of the elastic member 5 with the upper casing 3 or the lower casing 4 are substantially the same as each other. The contact area is desired to be as large as possible. By providing large area for supporting the printed board 2 by the elastic member 5, stress is not concentrated when the portable information radio terminal device 1 is subject to impact to prevent the printed board from vibrating or deflecting.

15 [0024]

As set forth above, the elastic member 5 supporting the printed board 2 abuts with the upper casing 3 and the lower casing 4 of the device body 1H. When the portable information radio terminal device 1 is fallen down, it tends to fall down to abut onto the ground from the upper surface of the upper casing 3 to be an operation surface and a display surface or from a back surface of the lower casing 4 located on the back side to easily cause impact. Associating with this, the elastic body 5 abut on the surfaces extending in surface direction of the upper surface and the back surface of the device body 1H

in order to enhance impact absorbing ability.

[0025]

Bonding of the elastic member 5 onto the printed board 2 and the upper and lower casings 3 and 4 is done by various adhesive. In this case, corresponding to a bonding force applied by the adhesive per se, clamping force to depress the elastic member 5 onto the printed board 2 from the upper and lower casings 3 and 4 may act.

[0026]

10 Material and elastic modules of the elastic member 5 are selected for effectively absorbing impact to be exerted onto the portable information radio terminal device 1 upon fallen down from a height supposed in normal use condition, and to effectively prevent failure of the electronic parts and/or
15 peeling off of the connecting portion.

[0027]

In the embodiment shown in Fig. 1(a), the elastic member 5 is arranged both between the printed board 2 and the upper casing 3 and between the printed board 2 and the lower casing
20 4. In the shown embodiment, the elastic member 5 is consisted of mutually separate elastic components respectively disposed between the printed board 2 and the upper casing 3 and between the printed board 2 and the lower casing 4. However, instead of forming the elastic member 5 with separated two elastic
25 components, it is possible to form it with a single elastic

component with a cut out portion for receiving the printed board 2 therein.

[0028]

Upon supporting the printed board 2 by an elastic force
5 of the elastic member 5, a direction to apply the elastic force
onto the printed board 2 matches with a direction to mating
and assembling the upper casing 3 and the lower casing 4 upon
manufacturing of the portable information radio terminal device
1 (horizontal direction in Fig. 1(a)). Accordingly, upon
10 manufacturing of the portable information radio terminal device
1, in the condition where the printed board 2 is placed at a
predetermined position on the inner surface of one of the upper
casing 3 and the lower casing 4 via the elastic member 5, the
other of the upper casing 3 and the lower casing 4 is fitted
15 via the elastic member 5 arranged on the inner surface. By this,
the elastic member 5 is properly pressurized with each other
with respect to the upper casing 3, the lower casing 4 and the
printed board 2. In this case, between the upper casing 3 and
the lower casing 4 preliminarily molded into predetermined
20 shapes, respectively, the elastic member 5 is disposed to adjust
the elastic force of the elastic member 5 acting on the printed
board 2 automatically and optimally. This can be achieved either
in the case where the elastic member 5 is formed with separated
two elastic components or in the case where the elastic member
25 5 is formed with one elastic member with the cut out portion.

[0029]

On the other hand, while not illustrated in the drawings, the elastic member 5 can be provided only on one side between the printed board 2 and the upper casing 3 and between the printed
5 board 2 and the lower casing 4.

Also, the printing board 2 is in cantilever support condition as being supported on one end portion in the longitudinal direction of the printed board 2 (but is supported with wide contact surface) in the shown embodiment. However,
10 it is also possible to support the elastic member 5 at both ends in the longitudinal direction.

[0030]

Next, the second embodiment of the present invention will be discussed with reference to Fig. 2.

15 [0031]

As shown in Fig. 2, the elastic members 5 are arranged in the vicinity of the CSP 6 mounted on the printed board 2 and are bonded at a plurality of positioned on the printed board 2. Among a plurality of elastic members 5, part of the elastic
20 members 5 are arranged on both end portions in the longitudinal direction of the printed board 2. The other part of the elastic members 5 are arranged in extension along the outer edge portion of the substantially quadrangular shaped CSPs 6.

[0032]

25 In the embodiment shown in Fig. 2, a ratio of total contact

area of a plurality of (five in the embodiment shown in Fig. 2) of elastic members 5 provided on the surface 2a and the surface 2a versus the area of the surface 2a on the side of the printed board where the CSPs 6 are mounted, is about 7.5%. It is also
5 desirable to bond a plurality of elastic members 6 even on the back surface of the surface 2a of the printed board 2. In view of stress distribution or impact absorption, it is desirable to bond the elastic members 5 on back sides of the printed board in a ratio of area greater than or equal to 5%. Furthermore,
10 the elastic members 5 provided at a plurality of positions on both of the surface and back sides of the printed board 2 can be provided at corresponding positions of the surface side and the back side, respectively. In the alternative, it is also possible to provide the elastic members 5 at mutually offset
15 positions on the surface side and the back side of the printed board 2.

[0033]

In the shown embodiment of the portable information radio terminal device 1, by holding the printed board 2 assembled
20 in the device body 1 with the elastic members 5 of impact absorbing material, it can prevent solder balls of the CSPs and the like mounted on the printed board 2 from breaking or peeling due to vibration or deflection of the printed board 2 in response to exertion of the impact by falling down or other reason.

25 [0034]

In particularly, in the embodiment shown in Figs. 1A and 1B, the printed board 21 assembled in the portable information radio terminal device 1 is held by the elastic member 5, such as impact absorbing material, disposed between the upper casing 3 and the lower casing 4. By this, the stress to be exerted upon receiving impact due to falling down or so forth, will not be concentrated to the one fixed point and be distributed to prevent the printed board 2 from causing significant vibration or deflection. Furthermore, as shown in Fig. 2, the effect can be further enhanced by bonding the elastic members 5 to a plurality of portions.

[0035]

It should be noted that while the shown embodiments take constructions to support the printed board 2 by the elastic member or members 5 disposed between the upper casing and the printed board 2 and/or between the lower casing and the printed board 2, the present invention should not be limited to a construction where the printed board 2 is supported only by the elastic member or members 5. When an external force, such as impact upon falling down or the like, is exerted on the portable information radio terminal device 1, the printed board 2 is supported at a plurality of positions or with a relatively large area or at a displaceable point so as to distribute the stress to a plurality of positions or to a wide region in order to avoid stress concentration to one position. Therefore, stress

can be distributed.

[0036]

With the embodiments set forth above, one effect is to solve the problem of breakage or peeling off of the CSPs mounted on the board. Therefore, influence of falling down impact of the portable telephone can be reduced. The reason is that, by holding the printed board with the elastic member without using screw, a portion supporting the printed board becomes wider to avoid concentration of the stress upon exertion of impact, such as falling down, to prevent vibration or deflection of the printed board.

[0037]

It should be noted that what is supported by the elastic member is not limited to the printed board but can be various boards mounting the electronic parts or can be the electronic part per se.

[0038]

[Effect of the Invention]

With the portable information radio terminal device according to the present invention, electrical connection of the electronic parts mounted on the board in the device body can be maintained even upon exertion of impact (external force) due to falling down of the portable information radio terminal device to minimize possibility of occurrence of failure of the electronic parts.

[Brief Description of the Drawings]

[Fig. 1]

Fig. 1 shows the first embodiment of a portable information radio terminal device according to the present invention, in which (a) is a front elevation, and (b) is a section taken along line A - A;

[Fig. 2]

Fig. 2 is a front elevation of a printed board and an elastic body of the second embodiment of a portable information radio terminal device according to the present invention; and

[Fig. 3]

Fig. 3 shows the conventional portable information radio terminal device according to the present invention, in which (a) is a front elevation, and (b) is a section taken along line A - A.

[Explanation of Reference Numerals]

- | | |
|-------|--|
| 1 | portable information radio terminal device |
| 1a | receiver portion |
| 1b | transceiver portion |
| 20 1c | display portion |
| 1d | operating portion |
| 1H | device body |
| 2 | printed board |
| 2a | surface of printed board on which CSP is mounted |
| 25 3 | upper casing |

- 4 lower casing
- 5 elastic body
- 6 CSP